Remarks

The Office Action mailed September 21, 2004 has been carefully reviewed and the following remarks have been made in consequence thereof.

Claims 1-21 are now pending in this application. This Amendment cancels Claims 2, 3, 5, 6, 8-11, and 13-18. This Amendment also adds Claims 22-35.

The objection to the Abstract as being insufficiently descriptive is respectfully traversed.

A replacement Abstract is provided. It is submitted that the replacement Abstract properly conforms to the required language and format and is adequately description of the subject matter of the application.

For the above reason, it is requested that the objection to the Abstract be withdrawn.

Figure 3 was objected to because "F2" was not disclosed in the specification and Fsub2 is not disclosed in the specification. This objection is respectfully traversed.

A replacement drawing for Figure 3 is provided. In this drawing, the notations F1 and F2 have been replaced with F_1 and F_2. It is submitted that one of ordinary skill in the art would recognize that, given the difficulty of rendering equation variables in different typefaces and in different computer programs, the substitution of regular type for a subscript type is a common typographical error. Thus one of ordinary skill in the art would recognize that, on Figure 3, F1 is a typographical error, the obvious replacement for which is F_1 and that F2 is also a typographical error, the obvious replacement for which is F_2. Also, Paragraph [0028] has been amended to disclose F_2. More particularly, after the recitation, "[a]n alternative version of G_1 is selected and defined as G_1', which is chosen to make y_o/x_2 behave optimally from the point of view of the forcing function x_i but without using feed forward ($F_1 = 0$)", a new recitation stating, "[t]he alternative versions for G_1 and G_1' are indicated as option 1 and option 2 in Figure 3, where, in option 1, $F_2=1$ and in option 2, $F_1=0$" has been added. Also, some subscripts "i" have been changed to subscripts "2".

The addition to Paragraph [0028] does not constitute new matter because one of ordinary skill in the art would recognize that "option 1" in Figure 3 clearly refers to F_1 being present as a gain block and F_2 having a gain of 1 (i.e., the block labeled F_2 can be replaced by a straight line from forcing function 104 directly into the [unlabeled] summer immediately to the right of F_2 and immediately below block 116). Such a person would recognize that option 1 is the configuration referred to in paragraphs [0026] and [0027]. On the other hand, the alternative option described in paragraph [0028] clearly corresponds to "option 2," because it matches the option shown in Figure 3 as having $F_1=0$, i.e., no use of the feed forward path. Moreover, one of ordinary skill in the art would recognize the subscripting errors in paragraph [0028] because equation 2) in Paragraph [0028] shows the value of y_o/x_i obtained in equation 1A) in Paragraph [0027] equal to the value of y_o/x_2 (i.e., $G_1'G_2/(1+G_1'G_2H)$ that would be obtained using the procedure set forth in Paragraph [0028]. In particular, the right hand side of equation 2) is obtained by selecting a new version of G_1 as G_1', setting $F_1=0$, and solving for the transfer function y_o/x_2. Equation 2) on the whole represents a transfer function for y_o/x_2 that behaves identically to the previously obtained transfer function, not using using G_1', for y_o/x_i. Therefore, the errors and corrections in Paragraph [0028] would both be obvious to one of ordinary skill in the art. Thus, it is submitted that the amendments to Paragraph [0028] do not add any new matter.

For the above reason, it is requested that the objection to Figure 3 be withdrawn.

Figure 4 was objected to because of extraneous wording, namely, the "Notes" below the servo control system diagram. This objection is respectfully traversed.

Figure 4 has been replaced by an amended Figure 4 with these Notes deleted. Paragraph [0030] of the text has been amended to incorporate these Notes. No new matter is added.

In addition, for consistency with Figure 3 and the discussion thereof, the letter "F" in the feed forward block at the left side of Figure 4 has been changed to "F_1" Correspondingly, the letter "F" to denote feed forward in the text and equations describing the configuration of

Figure 4 has been changed to "F_I", namely in paragraphs [0030], [0031], [0032], and [0034] and in equations contained therein.

For the above reason, it is requested that the objection to Figure 4 be withdrawn.

Claims 9, 15, 18, and 19 were objected to for various informalities. (The informalities in Claims 15 and 18 were not specified in the Office Action.) This objection is respectfully traversed.

Claims 9, 15, and 18 have been cancelled, so this objection no longer applies. Claim 19 has been amended as suggested in the Office Action.

It is therefore requested that the objection to Claims 9, 15, 18, and 19 be withdrawn.

Claims 1-6, 10-12, and 16-18 were rejected under 35 U.S.C. § 112, first paragraph for failing to disclose a method for conditionally differentiating. This rejection is respectfully traversed.

Claims 2-3, 4-6, 10-11, and 16-18 have been cancelled, so this rejection no longer applies to these claims.

Claim 1 as herein amended now recites a method comprising "...inputting a forcing function x_i to the servo system to direct the mechanical output to move in an intended manner; generating a difference signal at a monitoring point M representing a difference between forcing function x_i and a feedback signal dependent upon the mechanical output; injecting a feed forward signal into the servo system, said feed forward signal dependent upon the forcing function and effective to increase a detection threshold for collision stimulus at monitoring point M; and processing said difference signal to detect a collision," which is submitted as being a complete method for detecting collisions between an obstacle and an electromechanical system having a mechanical output controlled by a servo system, as recited in the amended preamble. Thus, it is submitted that the § 112, first paragraph rejection no longer applies to Claim 1.

Claim 4 is indirectly dependent upon Claim 1. When the recitations of Claim 4 are considered in combination with the recitations of Claim 1, it is submitted that the § 112, first paragraph rejection likewise no longer applies to Claim 4.

Claim 12 is not directed to a method. However, Claim 12 as herein amended is indirectly dependent upon Claim 7, which, as herein amended, recites "... An imaging system comprising: a radiation source; a radiation detector positioned to receive radiation emitted by said source; a servo system configured to position at least one of said source, said detector, and an object to be scanned; and said imaging system configured to input a forcing function x_i to the servo system to direct at least one of said source, said detector, and said object to be scanned to move in an intended manner; generate a difference signal at a monitoring point M representing a difference between forcing function x_i and a feedback signal dependent upon a mechanical output; injecting a feed forward signal in said servo system, said feed forward signal dependent upon the forcing function and effective to increase a detection threshold for collision stimulus at monitoring point M; and process said difference signal to detect a collision," in parallel with Claim 1. Thus, it is submitted that Claim 7 recites a complete structure, and that when the recitations of Claim 12 are considered in combination with those of Claim 7, that Claim 12 likewise recites a complete structure.

For the above reasons, it is requested that the § 112, first paragraph rejection of Claims 1-6, 10-12, and 16-18 be withdrawn.

Claims 1-6 and 19-21 were rejected under 35 U.S.C. § 112, second paragraph, as being incomplete for omitting essential steps. This rejection is respectfully traversed.

Claims 2-3 and 5-6, have been cancelled, so this rejection no longer applies to these claims.

Claim 1 has been amended as discussed above with respect to the § 112, first paragraph rejection. It is submitted that, in the amended form, all steps essential to the

claimed method for detecting collisions between an obstacle and an electromechanical system having a mechanical output controlled by a servo system are recited.

Claim 4 as herein amended is indirectly dependent upon Claim 1. When the recitations of Claim 4 are considered in combination with the recitations of Claim 1, it is submitted that Claim 4 likewise recites all steps essential to the claimed method.

Claim 19 has been amended and it is respectfully submitted that there are no omitted essential elements is the claimed method of operating the servo system.

For the above reasons, it is requested that the rejection of Claims 1-6 and 19-21 under 35 U.S.C. § 112, second paragraph be withdrawn.

Claims 1-3 were rejected under 35 U.S.C. § 102(b) as being anticipated by Evans, Jr.

Evans, Jr. is directed to a digital servo system for causing a mechanical element to track a desired path and hold various positions along the path and employing a lead/lag integrator in parallel with a feedback control loop. (Abstract) A feed forward term (Fig. 8, #22) is injected into the servo system. The invention of Evans, Jr. has as its objects to improve servo positioning systems, to increase stiffness of such systems during holding and pathtracking, to employ both position and velocity integration in a servo positioning system in such a manner that stiffness is improved during both holding and pathtracking, and to provide an improved servo positioning system adaptable to digital implementation. Evans Jr. is not concerned with collisions between an obstacle and an electromechanical system, and thus does not teach or discuss making the injected signal both dependent upon the forcing function and effective to increase a detection threshold for collision stimulus at a monitoring point M, and processing the difference signal to detect a collision.

By contrast, Applicant's Claim 1, as herein amended, recites, "... injecting a feed forward signal into the servo system, said feed forward signal dependent upon the forcing function and effective to increase a detection threshold for collision stimulus at monitoring point M; and processing said difference signal to detect a collision." See Applicant's

originally filed specification at Figure 3 and at paragraphs [0028], [0029], and further at page 7, paragraph [0026] (especially at page 7, lines 6-16 from the top of the page), paragraph [0037], and the last sentence of paragraph [0035]. Thus it is submitted that Claim 1, as herein amended, is patentable over Evans, Jr.

This rejection no longer applies to Claims 2 and 3, which have been cancelled.

For the reasons given above, it is requested that the § 102(b) rejection of Claims 1-3 as being anticipated by Evans, Jr. be withdrawn.

Claims 1-6 were rejected under 35 U.S.C. § 102(b) as being anticipated by Yim. Because reasons were also given for rejecting Claims 13-18, as well, this rejection is treated herein as a rejection of Claims 1-6 and 13-18 as being anticipated by Yim. This rejection is respectfully traversed.

This rejection no longer applies to Claims 2-3, 5-6, and 13-18, which have been cancelled.

Yim is directed to a velocity control method for use in a servo motor having a disturbance eliminator. Although unknown disturbances are input to the control system, a velocity error is conversed into zero as closely as possible to enable an accurate velocity control. (Abstract) The object of the invention is to provide a velocity control method that makes it possible to converge a control error into zero as closely as possible all the time irrespective of a disturbance applied to a servo motor. However, Yim is not concerned with collisions between an obstacle and an electromechanical system, and thus does not teach or suggest making the injected signal both dependent upon the forcing function and effective to increase a detection threshold for collision stimulus at a monitoring point M, and processing the difference signal to detect a collision.

By contrast, Applicant's Claim 1, as herein amended, recites, "... injecting a feed forward signal into the servo system, said feed forward signal dependent upon the forcing function and effective to increase a detection threshold for collision stimulus at monitoring

point M; and processing said difference signal to detect a collision." See Applicant's originally filed specification at Figure 3 and at paragraphs [0028], [0029], and further at page 7, paragraph [0026] (especially at page 7, lines 6-16 from the top of the page), paragraph [0037], and the last sentence of paragraph [0035]. Thus it is submitted that Claim 1, as herein amended, is patentable over Yim.

Claim 4, as herein amended, depends indirectly upon Claim 1. When the recitations of Claim 4 are considered in combination with the recitations of Claim 1, it is submitted that Claim 4 is likewise patentable over Yim.

For the above reasons, it is requested that the § 102(b) rejection of Claims 1-6 as being anticipated by Yim be withdrawn, as well as any rejection of Claims 13-18 over Yim under the same section.

Claims 19-21 were rejected under 35 U.S.C. § 102(e) as being anticipated by Tomita. This rejection is respectfully traversed.

Applicant respectfully traverses the assertion in the Office Action at page 6 that "Tomita discloses a method of configuring a servo system, wherein said method comprises reducing the initial aggressiveness (response) level for responding to a collision (disturbance); and maintaining the desired aggressiveness (response) level for responding a disturbance is not detected (Fig. 11, when Td is present this increases the value of ɵ, which decreases the initial aggressiveness, ɵr. When Td is not present, ɵr remains the same". Rather, Tomita describes that "the disturbance response depends only on the denominator of the transfer function from the disturbance T2 to theta2". Tomita is silent with respect to "reducing the initial aggressiveness level for responding to a collision; and maintaining the desired aggressiveness level for responding to the input". Therefore, it is respectfully submitted that Claim 19 is patentable over Tomita.

Claims 20-21 depend from Claim 19. When the recitations of Claims 20-21 are considered in combination with the recitations of Claim 19, it is submitted that Claims 20-21 are likewise patentable over Tomita.

For the above reasons, it is requested that the rejection of Claims 19-21 as being anticipated by Tomita be withdrawn.

Claims 7 and 8 were rejected under 35 U.S.C. § 102(e) as being anticipated by Hazelton et al. This rejection is respectfully traversed.

This rejection no longer applies to Claim 8, which has been cancelled.

Hazelton et al. is directed to a repositioning method in which a system performs operations relative to areas on a substrate by a series of relative movements between the system and substrate scanning exposures. (Abstract) Although a feedforward controller is shown injecting a feed forward term into a servo system in Figure 7, Hazelton et al. are not concerned with collisions between an obstacle and an electromechanical system, and thus do not teach or discuss making the injected signal both dependent upon the forcing function and effective to increase a detection threshold for collision stimulus at a monitoring point M, and processing the difference signal to detect a collision.

By contrast, Claim 7, as herein amended, recites, "... said imaging system configured to input a forcing function x_i to the servo system to direct at least one of said source, said detector, and said object to be scanned to move in an intended manner; generate a difference signal at a monitoring point M representing a difference between forcing function x_i and a feedback signal dependent upon a mechanical output; injecting a feed forward signal in said servo system, said feed forward signal dependent upon the forcing function and effective to increase a detection threshold for collision stimulus at monitoring point M; and process said difference signal to detect a collision." See Applicant's originally filed specification at Figure 3 and at paragraphs [0028], [0029], and further at page 7, paragraph [0026] (especially at page 7, lines 6-16 from the top of the page), paragraph [0037], and the last sentence of

paragraph [0035]. Thus it is submitted that Claim 7, as herein amended, is patentable over Hazelton et al.

For these reasons, it is requested that the § 102(e) rejection of Claims 7 and 8 as being anticipated by Hazelton et al. be withdrawn.

Claims 9-12 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Hazelton et al. as applied to Claim 7 and further in view of Yim.

This rejection no longer applies to Claims 9-11, which have been cancelled.

Hazelton et al. is as described above. Hazelton et al. do not teach or suggest making the injected signal both dependent upon the forcing function and effective to increase a detection threshold for collision stimulus at a monitoring point M, and processing the difference signal to detect a collision. Yim is also discussed above with respect to Claim 1. Yim also does not teach or suggest making the injected signal both dependent upon the forcing function and effective to increase a detection threshold for collision stimulus at a monitoring point M, and processing the difference signal to detect a collision. Therefore, the combination of Hazelton et al. and Yim also do not teach or suggest making the injected signal both dependent upon the forcing function and effective to increase a detection threshold for collision stimulus at a monitoring point M, and processing the difference signal to detect a collision. Thus, it is submitted that Claim 7 is patentable over Hazelton et al. in view of Yim.

Claim 14 is indirectly dependent upon Claim 7. When the recitations of Claim 14 are considered in combination with the recitations of Claim 7, it is submitted that Claim 14 is likewise patentable over Hazelton et al. in view of Yim.

Thus, it is requested that the rejection of Claims 9-12 under 35 U.S.C. § 103(a) as being unpatentable over Hazelton et al. as applied to Claim 7 and further in view of Yim be withdrawn.

Dependent Claims 22-25 are new. These Claims recite additional patentable features themselves and/or are patentable by virtue of their direct or indirect dependency on Claim 1.

Independent Claim 26 is new. Claim 26 recites features similar to those recited above and shown to be patentable over the art of record. Thus, it is submitted that Claim 26 is likewise patentable over the art of record.

Dependent Claims 27-31 are new. These Claims recite additional patentable features themselves and/or are patentable by virtue of their direct or indirect dependency on Claim 26.

Dependent Claims 32-35 are new. These Claims recite additional patentable features themselves and/or are patentable by virtue of their direct or indirect dependency on Claim 7.

In view of the foregoing amendments and remarks, all the claims now active in this application are believed to be in condition for allowance. Reconsideration and favorable action is respectfully solicited.

Respectfully Submitted,

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IN THE FIGURES

Please replace sheets 2 and 3, corresponding to Figures 3 and 4, respectively, with the replacement sheets attached herewith. Please note that attached is a complete set of Figures.

Figure 3 (which appears on sheet 2), as further explained in the Remarks, has been changed to replace notations "F1" and "F2" with "F_1" and "F_2", respectively.

Figure 4 (which appears on sheet 3), as further explained in the Remarks, has been changed by deletion of the extraneous wording objected to by the Examiner. In addition, the letter "F" in a block at the left side of Figure 4 has been changed to "F_1".